

REMARKS

Claim 1 is amended in the first line to return to its original recitation, that does not refer to the order of a light wavelength. As is explained below, the discovery of the Bennett and Mattsson reference obviates reference to a light wavelength. A definition of "specular" from page 9, line 16 of the specification is added to the first line of claim 1.

A paragraph on page 11, about chrome plating, is requested to be deleted because the Applicant now believes that is it incorrect. The paragraph above is amended likewise.

The Bennett and Mattsson reference is submitted via an IDS to ensure consideration, because the Examiner stated in the second Advisory Action that it was material to patentability. The Applicant respectfully maintains that this reference is not prior art, for the reasons of record in the Communication of February 19, 2003.

The attached graph, extrapolated the Bennett and Mattsson reference graph at page 36, is re-submitted. A second declaration is attached relating to the extrapolation of the graph. The declaration submitted with the Communication of February 19 is re-submitted in the form of a copy to ensure consideration.

In response to the Final Office Action mailed October 3, 2002.

[3] Claims 1, 5, and 7 were rejected under §102 over Williams '071. This rejection is respectfully traversed.

Williams discloses a hard coating on a surface of stainless steel, and states (col. 2, line 36): "Whilst the surface finish of the blank is not critical, it is highly desirable that it is not highly polished and not overly rough. It is therefore preferred that the surface finish [is between] 0.1 RA and 2.0 RA."

Claim 1 as amended recites a surface that is "specular." *Surface Roughness and Scattering*, by **Bennett and Mattsson**, deals with the relationship between surface finish and specularity. This book, published by the Optical Society of America, is written by experts on this topic (the Examiner is referred to the included biographies).

(1) The Examiner is first invited to note the statement at page 3, column 1, line 17, that a roughness of 0.1 μm (the lower limit of Williams' disclosed range) is typical of machined surfaces and that optical surfaces (i.e. specular surfaces) are smoother. (This statement conforms with other references, discussed below.)

(2) Fig. 9 on page 25 shows an experimental setup for finding the ratio of scattered light to total light ("TIS" for total integrated scattering), using laser beams; the discussion starts on page 24. Since the total light is the sum of the scattered light and the specularly-reflected light, the higher this fraction is, the less specular is the surface.

A theoretical prediction relating roughness to specular reflection is shown in Fig. 10 on page 26. The vertical axis is the TIS fraction, and the horizontal axis is rms roughness in Angstroms. The middle line on the graph is visible light (red He-Ne laser light, 0.633 μm wavelength), the others are infrared and ultraviolet. The theoretical prediction of Fig. 10 is experimentally verified, within the range of interest (page 27, lines 9-11).

The roughness measure rms of Fig. 10 is shown by the Salmon reference (discussed below) to be close to R_s , which the Examiner takes to be the same as the "RA" of Williams.

The Applicant has extrapolated the graph of Fig. 10 toward $\text{rms} = 0.1 \mu\text{m}$ (1000 Angstroms), by pasting on a photocopy of the lower axis. The extrapolated graph shows that, when $\text{rms} = 500 \text{ Angstroms}$ (i.e., 0.05 μm), *all* of the light is scattered; the Examiner is referred to the attached Second Declaration. The quantity TIS on the vertical axis is defined as the ratio of scattered to total light, so when TIS equals 10^0 (i.e., 1), the scattered light is equal to the scattered light plus the specularly reflected light—which means that there is no specular reflection at all.

Even for the infrared light of wavelength 1.0 μm , there is no reflection at all when the surface finish is "0.1 RA" as taught by Williams.

The Examiner is invited to note the indicated passage on page 31 stating that TIS yields roughness values traceable to the ASTM standard.

(3) Table 2 on page 36 shows polished surfaces with roughness less than 0.00051 μm . This shows that a typical polished, optical, specular surface is far below Williams' range.

(4) On page 39, under heading 4.A.2, the authors state that R_a is the usual figure for machined surfaces, not for optical surfaces. This implies that Williams discloses machined, not optical surfaces, because its uses that measure (i.e., "RA")..

(5) On page 48, the third paragraph in the first column, together with the second column on page 38, supports the Applicant's argument (Amendment of July 1, 2002, page 3) that RA alone is not directly related to specularity, because L is not determinate.

Modern Grinding Process Technology, by **Salmon**, shows in Fig. 11.2 (fourth page of the attachment) that RMS is nearly the same as R_a (as noted above).

Grinding and Polishing Theory and Practice, by **Burkart/Schmotz**, shows a polished (specular) surface in Fig. 21 on page 24 with a surface roughness less than "10 AE." The abbreviation "AE" is believed to have appeared in the original German diagram, and to stand for "Angstrom Einheit"("Angstrom Unit"); pages from a dictionary and an encyclopedia are attached in support of this translation.

Mechanical Polishing by **Burkart, Silman, and Draper** shows in Fig. 14 on page 18 a graph of a polished surface showing peak-to-valley roughness of 0.05 μm . The RMS or R_a roughness would be smaller than that; the Examiner is invited to note Salmon Fig. 11.2.

As the Applicant previously noted, Williams teaches against a "highly polished" surface and this is consistent with a teaching against a specular surface. In view of the new information above, Williams discloses a honed surface that is not at all specular. Thus, Williams does not anticipate.

[4] Claims 1-3, 6, and 7 are rejected under §103 over Bache '058 in view of Lane '329. This rejection is respectfully traversed on the grounds of record, i.e., that the rejection is based on guesswork by Lane and further guesswork by the Examiner. The Examiner speculates that Lane's imaginary skittering molecules will form a specular surface, but there is no support for this either in the reference or by way of reasoned argument.

[5] Claims 1, 2, and 4 are rejected under §103 over Lane '579. This rejection is respectfully traversed on the grounds that the Examiner has not provided a reference to support any of the assertions made on the basis of Official Notice, as is required by the MPEP.

[6] As noted above, several portions of Bennett and Mattsson support the Applicant's previous arguments, which are respectfully maintained.

The Examiner asserts that chromium is known to be specular. The Applicant respectfully traverses on the basis of his personal information, gained in making the model referred to in the attached affidavit. The Applicant was informed by Hard Chrome Specialists in York, PA (who plated the model) that the underlying surface would need to be polished if the chromium plating were to be specular.

Allowance of all claims under consideration is respectfully solicited.

Respectfully submitted,



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Attached: Version with Markings, copy of Declaration of February 25, Second Declaration, extrapolated graph from Bennett and Mattsson

VERSION WITH MARKINGS TO SHOW CHANGES

IN THE CLAIMS

1. (Amended) A blade, comprising:

 a substrate including a specular surface, wherein at least some reflected image is visible on the surface; [whereby the surface is smooth on the order of a light wavelength;] and

 a thin, hard plate deposited on the specular surface [, whereby the hard plate is microscopically flat , on the order of a light wavelength];

 wherein the substrate is beveled toward a cutting edge of the blade; [including the hard plate] and

wherein the cutting edge comprises the thin, hard plate; [,]

 whereby the cutting edge is straight [, on the order of a light wavelength,] in a cutting direction.

IN THE SPECIFICATION

Amend the paragraph starting at page 11, line 1:

 The surface on which the ceramic 20 is coated may be mechanically polished, electro-polished, or otherwise polished, for example by liquid flow or melting. Preferably an ordinary non-specular blade (or a portion near the edge) is plated with a secondary coating layer 12 which has a specular outer surface due to the plating or polishing process and needs no further polishing. One example is ["decorative"] chromium plating, which is applied via a widely-used process.

26 HOW DO WE MEASURE ROUGHNESS?

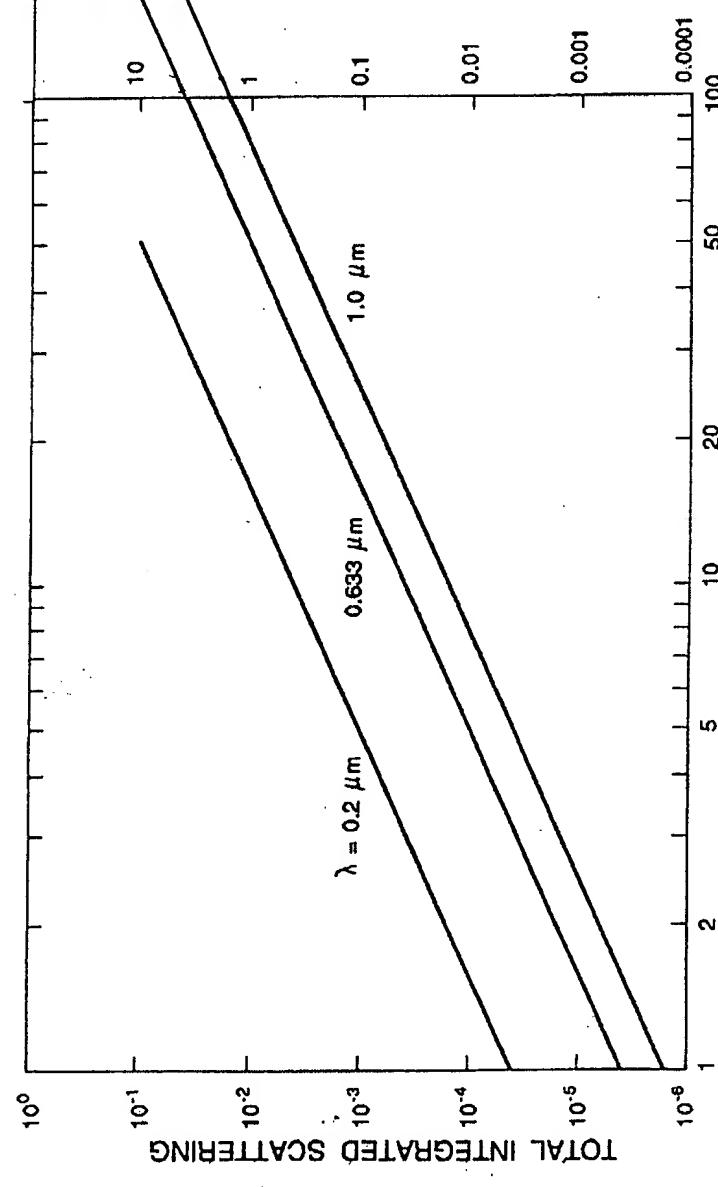


Fig. 10. Calculated TIS as a function of rms roughness for wavelengths of 0.2, 0.633, and 1.0 μm .

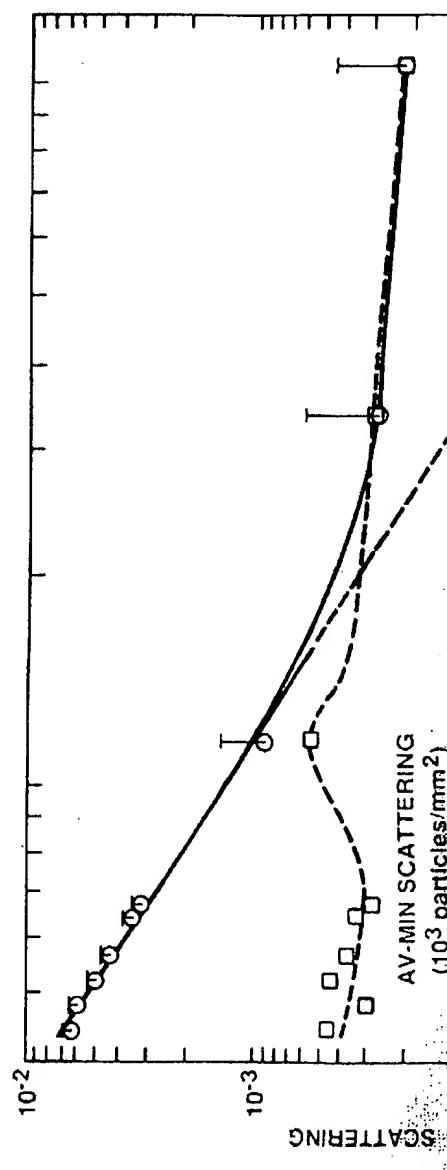


Figure 11 shows the variation of TIS as a function of rms roughness for a polished dense flint glass surface.¹¹⁷ Since the logarithm of the scattering remains nearly constant, a straight line with a slope of -5×10^{-3} is in agreement between the theory and to a scattering level of about 5×10^{-3} . The graph of the average minus the minimum at each wavelength and probably represents particulate scattering to the TIS. The wavelength dependence of the TIS has been verified with experiment in the 0.25 μm in the UV to 1.15 μm in the measured by TIS correlate well with profiling techniques for selected surfaces in the 1-100- \AA rms range.^{81,122} If radii are less than 1 μm , the profiler values tend to be higher because they are not resolved by the visible light.

